AF/1773
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TRANSMITTAL OF APPEAL BRIEF (Large Entity)	Docket No. 08CN8803-16

In Re Application Of: **Thomas P. Feist, et al.**

Serial No.	Filing Date	Examiner	Group Art Unit
09/846,889	**May 1, 2001**	**K. Bernatz**	**1773**

Invention: **METHOD FOR RETREIVING DATA FROM A STORAGE MEDIA WITH A SUBSTRATE INCLUDING AT LEAST ONE PLASTIC RESIN PORTION**

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on

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08CN8803-16

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Thomas P. Feist, et al.	)
		) Group Art Unit: 1773
Serial No.:	09/846,889	)
		)
Filed:	May 1, 2001	) Examiner: K. Bernatz
		)
For:	METHOD FOR RETREIVING DATA FROM A STORAGE MEDIA WITH A SUBSTRATE INCLUDING AT LEAST ONE PLASTIC RESIN PORTION	))))

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APPEAL BRIEF

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is General Electric Company.

II. RELATED APPEALS AND INTERFERENCES

There are two other appeals known to Appellant that may directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal; namely the appeal of U.S. Patent Application No. 09/683,114 to Davis et al. and the appeal of U.S. Patent Application No. 09/845,743 to Feist et al. There are no interferences know to Appellant, Appellant's legal representatives, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF THE CLAIMS

Claims 1 – 60 are pending in the application. All of the pending claims stand rejected. The rejection of Claims 1 – 60 is appealed. Claims 1 – 60, as they currently stand, are set forth in Appendix A.

IV. STATUS OF AMENDMENTS

Claims 1, 5-8, 11-13, 18, 21, and 56-58 were amended in an amendment submitted November 17, 2003; the amendment was entered after Appellants filed a Request for Continued Examination on December 16, 2003. In preparing this Appeal Brief, Appellants note, however, that "disposed" should be deleted from Claim 8 and "plastic portion" should be changed to "plastic resin portion" in Claim 60. Appellants are willing to make these amendments for clarity if the claims herein are otherwise found allowable.

V. SUMMARY OF THE INVENTION

This application relates to a method for retrieving data from a storage media. Optical, magnetic, and magneto-optic media, primary sources of high performance storage technology, enable high storage capacity coupled with a reasonable price per megabyte of storage. Improved areal density represents one of the key factors in the price reduction per megabyte, with further increases in areal density continuously demanded by the industry. (Paragraph [0004])

Only areas such as compact disks (CD), and similar relatively low areal density devices, e.g., less than about 1 Gbit/in^2, have employed polymeric data storage media; read-through devices requiring a good optical quality substrate having low birefringence. (Paragraph [0006]) Storage media of higher areal densities, e.g., greater than 5 Gbits/in^2, employ first surface or near field read/write techniques. Although such storage media don't rely on optical quality, the physical and mechanical properties of the substrate become increasingly important. For high areal density applications, including first surface applications, the surface quality of the storage media can affect the accuracy of the reading device, the ability to store data, and replication qualities of the substrate. Furthermore, the physical characteristics of the storage media when in use can also affect the ability to store and retrieve data; i.e., the axial displacement of the media, if too great, can inhibit accurate retrieval of data and/or damage the read/write device. (Paragraph [0008])

Conventionally, storage media employing first surface, including near field, techniques utilized metal (e.g., aluminum) and glass substrates. Disks of these substrates had the desired layers disposed thereon using various techniques, such as sputtering. (Paragraph [0009]) Evident from the fast pace of the industry, the demand for greater storage capacities at lower prices, the desire to have re-writable disks, the steady introduction of new products to the marketplace, and the numerous techniques being investigated, the industry constantly strives for further advances in the technology. (Paragraph [0010])

Data storage constitutes a crowded, very active, and very innovative area of technology. In the early 1980s, most people familiar with computers worked on terminals connected to very large mainframe computers that stored all of the data. These mainframe computers ("main

frames") were the size of small rooms. By the end of the 1980s, many people, particularly college students and businesses, owned and worked on personal computers that stored data locally, in computers the size of boxes that readily fit beneath a desk, and/or on floppy disks (i.e., a media that required a solid plastic housing due to its highly flexible nature) that stored a maximum of less than 1 megabyte (MB) of data. Then the smaller floppy disk, storing more data (i.e., 1.44 MB of data), further advanced the technology. Even with the constant desire to store greater amounts of data in smaller spaces and the knowledge of the desirability of a media that could accomplish such storage, the smaller floppy disk established a non-obvious advancement over the original floppy disk.

The need for more storage and speed from the storage media drove the industry from the floppy disks to hard disks. Some of the original hard disks stored more data, yet in a very large area (e.g., up to half a meter in diameter), and weren't generally publicly availability. Hard disk availability to the general public increased around the early 1990s as the disk price and size decreased. Throughout the 1990s, the industry continued to drive toward smaller, faster, cheaper, higher capacity, hard disks. Hard disk drives became common in home computers as well as in personal computers used in businesses. Eventually the limiting factor for these hard disks, however, became the physical capability of putting additional data thereon. New recording head and magnetic thin film technology has resulted in continual increases in data density, but the rate of increase has slowed. Reaching technological limits of data density (bits per square inch), newer disks approach the "super-parametric limit" where additional data disposal onto the disk has the potential for spontaneous loss of data due to demagnetization.

Further advancement toward greater densities and/or smaller size required redirection of the technology. Appellants have discovered a way to increase the capacity of data storage media beyond that previously available. To address the industry needs, Appellants developed a data storage media capable of attaining an areal density of greater than about 20 Gbits/in^2, with areal densities even up to and exceeding about 100 Gbits/in^2 anticipated. (Paragraph [0031]) The claimed method of data retrieval comprises: rotating a storage media, directing an energy field at the storage media, and retrieving information from a data layer via an energy field. The storage

media comprises a plastic resin portion disposed between a data layer and a substrate. The storage media has a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation. (Claims 1 – 60)

Appellants further teach and claim rotation of the media at a variable speed, a resonant frequency of greater than about 250 Hz, a first modal frequency greater than an operating frequency, a first modal frequency outside of an operating frequency, core designs, plastic resin portion and substrate thicknesses, coercivity, areal density, surface features, replication, edge-lift height, mechanical damping coefficient, axial displacement, moment of inertia, roughness, moisture content, specific gravity, substrate materials, plastic resin portion materials, reinforcement, and flexural modulus. Appellants further advanced storage media technology.

VI. ISSUES

1. WHETHER CLAIMS 11 – 13 AND 18 FAIL TO COMPLY WITH THE WRITTEN DESCRIPTION REQUIREMENT OF 35 U.S.C. §112, FIRST PARAGRAPH?

2. WHETHER CLAIMS 1, 5 - 7, AND 11 – 59 ARE OBVIOUS IN VIEW OF U.S. PATENT NO. 5,538,774 TO LANDIN ET AL. AS EVIDENCED BY U.S. PATENT NO. 5,972,461 TO SANDSTROM, QUANTEGY PROFESSIONAL MEDIA, HTTP://WWW.PNCENGINEERING.COM/MODSPEC (HEREINAFTER "QUANTEGY"), U.S. PATENT NO. 5,981,015 TO ZOU ET AL., U.S. PATENT NO. 6,030,681 TO CZUBAROW ET AL., U.S. PATENT NO. 5,948,495 TO STANISH ET AL., U.S. PATENT NO. 6,127,017 TO HIRATA ET AL.,U.S. PATENT NO. 6,194,045 B1 TO ANNACONE ET AL., U.S. PATENT NO. 5,866,489 TO YAMAGUCHI, U.S. PATENT NO. 6,236,542 B1 TO HARTOG ET AL., U.S. PATENT NO. 5,741,403 TO TENHOVER ET AL., U.S. PATENT NO. 4,987,020 TO BONNEBAT ET AL., U.S. PATENT APPLICATION NO. 2001/0022705 A1 TO MORI ET AL., U.S. PATENT NO. 5,585,159 TO MIYAKE ET AL., U.S. PATENT NO. 5,585,989 TO KUROMIYA ET AL. AND U.S. PATENT NO. 5,875,083 TO ONIKI ET AL.?

3. WHETHER CLAIMS 1, 4 - 7, 11-31, 33-36, 39, 42, 45, 46, 48, 51-53, AND 56-59 ARE OBVIOUS OVER U.S. PATENT NO. 6,433,964 B1 TO CHANG AS EVIDENCED BY SANDSTROM, QUANTGEY, ZOU ET AL., CZUBAROW ET AL., STANISH ET AL., HIRATA ET AL., ANNACONE ET AL., YAMAGUCHI, HARTOG ET AL., TENHOVER ET AL., BONNEBAT ET AL., MORI ET AL., MIYAKE ET AL., KUROMIYA ET AL., AND ONIKI ET AL.?

4. WHETHER 1, 5 - 7, 11-30, 32, 33 AND 37-59 ARE OBVIOUS OVER JP 63-205817A ABSTRACT TO OTADA ET AL. IN VIEW OF LANDIN ET AL. AS EVIDENCED BY SANDSTROM, QUANTGEY, ZOU ET AL., CZUBAROW ET AL., STANISH ET AL., HIRATA ET AL., ANNACONE ET AL., YAMAGUCHI, HARTOG ET AL., TENHOVER ET AL., BONNEBAT ET AL., MORI ET AL., MIYAKE ET AL., KUROMIYA ET AL., ONIKI ET AL., U.S. PATENT NO. 5,119,259 TO KIKUCHI, U.S. PATENT NO. 4,742,420 TO OISHI, U.S. PATENT NO. 5,552,009 TO ZAGER ET AL., U.S. PATENT NO. 5,292,550 TO FUJII ET AL., U.S. PATENT NO. 6,165,391 TO VEDAMUTTU?

5. WHETHER CLAIMS 32, 37, 38, 40, 41, 43, 44, 47, 49, 50, 54, AND 55 ARE OBVIOUS OVER CHANG IN VIEW OF LANDIN ET AL.?

6. WHETHER CLAIMS 2, 8 – 10, AND 60 ARE OBVIOUS OVER LANDIN ET AL. OR CHANG IN VIEW OF HIRATA ET AL. OR OBVIOUS OVER OTADA ET AL. IN VIEW OF LANDIN ET AL. AND FURTHER IN VIEW OF HIRATA ET AL.?

7. WHETHER CLAIM 3 IS OBVIOUS OVER LANDIN ET AL. OR CHANG IN VIEW OF U.S. PATENT NO. 6,411,457 B2 TO YAMASHITA ET AL.OR OBVIOUS OVER OTADA ET AL. IN VIEW OF LANDIN ET AL. AND FURTHER IN VIEW OF YAMASHITA ET AL.?

8. WHETHER CLAIM 4 IS OBVIOUS OVER LANDIN ET AL. IN VIEW OF U.S. PATENT NO. 6,156,422 TO WU ET AL. OR OBVIOUS OVER OTADA ET AL. IN VIEW OF LANDIN ET AL. AND FURTHER IN VIEW OF WU ET AL.?

VII. GROUPING OF CLAIMS

The claims do not stand together. The claims are directed to various novel methods, characteristics, properties, and/or designs of data storage media. These methods, characteristics, properties, and designs are not obvious in view of other claimed methods, characteristics, properties, and designs. For example, rotating at a variable speed (e.g., Claim 2) is not obvious

in view of an areal density (e.g., Claims 5 – 7). Additionally the modal frequencies (e.g., Claims 56 – 58) are not obvious in view of the core designs, edge-lift, roughness, moments of inertia, or other claimed characteristics, properties, and designs. The resonant frequency (e.g., Claim 28) is not obvious in view of the areal density, core designs, mechanical dampening coefficient, edge-lift, and the like. The novel methods, characteristics, properties, and designs are not obvious in view of other claimed methods, characteristics, properties, and/or designs, and all add patentable distinction. The grouping of claims is as follows: Group I (Claim 1); Group II (Claim 2); Group III (Claim 3); Group IV (Claim 4); Group V (Claims 5 – 7); Group VI (Claims 8, 9, and 60); Group VII (Claim 10); Group VIII (Claims 11 – 13); Group VIX (Claims 14 and 15); Group X (Claim 16); Group XI (Claims 17 and 18); Group XII (Claims 19 and 20); Group XIII (Claims 21 – 23); Group XIV (Claim 24); Group XV (Claims 25 and 26); Group XVI (Claim 27); Group XVII (Claim 28); Group XVIII (Claim 29); Group XIX (Claims 30 – 32); Group XX (Claim 33); Group XXI (Claim 34); Group XXII (Claims 35 and 36); Group XXIII (Claim 37); Group XXIV (Claim 38); Group XXV (Claim 39); Group XXVI (Claims 40 and 41); Group XXVII (Claims 42 and 45); Group XXVIII (Claims 43 and 44); Group XXIX (Claim 46); Group XXX (Claim 47); Group XXXI (Claim 48); Group XXXII (Claims 49 and 50); Group XXXIII (Claim 51); Group XXXIV (Claim 52); Group XXXV (Claims 53 – 55); Group XXXVI (Claims 56 and 57); Group XXXVII (Claim 58); Group XXXVIII (Claim 58); and Group XXXIX (59).

VIII. ARGUMENT

A. CAUSE EFFECTIVE VARIABLES AND NECESSARILY PRESENT

As the data storage industry screams forward at an incredible rate, data storage media receives numerous advances and discoveries, rendering it a crowded area. Clearly evident in many homes within the United States, technology surrounding data storage has changed drastically in the past thirty (30) years. Whereas thirty (30) years ago many Americans were not familiar with a computer, how it works, or its potential uses, computers hold a prevalent position in American homes today. Main frames are no longer prominent, personal computers replaced

these "archaic" devices. Even preschoolers use computers for learning and play games, while elementary school children employ computers for research and preparing homework assignments. The video industry similarly changed drastically, e.g., from the old reel film (on which many people still have "old movies"), to video cassettes, and more recently to DVDs. Compact disks are replacing cassette tapes.

A constant desire and need exists to improve storage media; e.g., to find new ways to store greater amounts of data in even smaller spaces. However, a mere need or desire, or a generic claim of a "better media", a "flat" surface, a "low" roughness, etc., does not constitute a teaching of how to attain those properties. These relative terms must be understood in the context of the case in which they are discussed. In other words, an artisan would read those claims in relation to the technology at the time of the reference (what they could have possibly meant by their teaching), and not in hindsight provided by Appellants application.

It appears to be the Examiner's position that all properties that would improve a storage media (e.g., move it to the next generation), are obvious (mere optimizations) and that one of ordinary skill in the art would obtain such media without undue experimentation; i.e., with "mere optimization". Appellants disagree that advances in this technology constitute obvious, "necessarily present", "necessarily possessed", "mere optimizations", or that the properties can properly be termed "cause effective variables" or "result effective variables".

For example, even though players in the automotive industry race to produce a vehicle with zero emissions for nitrogen oxides (NOx), hydrocarbons (HC), and carbon monoxide (CO), in order to meet the mandated emissions regulations coming into effect within the next decade or so, and even though all players have identified the goal of zero emissions (a very specific, clearly identified number), and even though thousands of references discuss reduced or improved exhaust emissions, an actual a zero emissions vehicle is non-obvious. Zero emissions is not a cause/result effective variable attained via "mere optimization"; it constitutes a challenge to the industry requiring innovation and research. Merely stating that the industry identified a certain emissions level, that one of ordinary skill in the automotive industry would desire zero emissions, that the industry has discussed improved/reduced emissions, and that the references

all discuss the use of the "same systems", e.g., combinations of exhaust emission control devices (e.g., catalytic converters, particulate filters, oxidation catalysts, NOx traps, sulfur traps, sensors, etc.), does not make "zero emissions" a cause/result effective variable, establish a *prima facie* case of obviousness nor render a system that actually meets the zero emissions standard obvious. Merely identifying a variable fails to prove or even suggest that control (increasing or decreasing) the variable is routine experimentation or mere optimization. Even the knowledge of the requirement for zero emissions and with all of the teachings of various equipment for reducing emissions, zero emissions does not become a "mere optimization", a "cause effective variable", or "necessarily present" in cars discussing similar pieces of equipment or even in vehicles seeking reduced emissions. Furthermore, simply listing these facts fails to establish a *prima facie* case of obviousness and fails to shift the burden to the Appellant.

For a variable to be "cause effective", "result effective", or "mere optimization", the variable must achieve a recognized result *and* must be attainable by routine experimentation. (MPEP 2144.05.II.B) The mere recognition of a desired result, e.g., zero emission, high areal or recording density, or the like, does not render that property attainable by "routine experimentation" or "mere optimization". Firstly, if attaining the properties claimed by Appellants were "cause effective variables" that constitute mere optimization requiring only routine experimentation, why haven't these properties been regularly attained and employed in the media? For example, refer to the article "A Study on Spin Coating Method for Cover Layer of Blu-ray Disc," by Tae-Sik Kang et al., presented at the International Symposium on Optical Media, 2003 (pp. 298 – 299) (hereinafter "Kang et al."; attached hereto as Exhibit B). This article published about two (2) years after the filing of the present application and about four (4) years after the filing of the parent application. Kang et al. discuss spin coating, issues of ski-jump (i.e., edge-lift), and provide an example of a polycarbonate substrate with a UV curable resin having a thickness of 100 ±2 micrometers (μ) thereon. Table 1 shows that the edge-lift ranges from 6.2μ to 54.3μ on a 100μ thick coating. In other words, an edge lift of less than about 8 μ is not "necessarily possessed" by a storage media having at least one plastic portion; not even on a storage media produced after the publication of the present application. Merely because a

storage media has a property does not mean that the media meets the claimed limitation, or that "mere optimization" or "routine experimentation" will attain the claim element. Even in 2003, Kang et al. discuss "conventional" media, as media with edge-lifts of greater than 50 micrometers (μ). (Kang et al., page 299)

The Examiner contends that:

> Applicants have presented no experimental evidence that the closest prior art... would be incapable of obtaining these properties nor whether the disclosed properties would necessarily flow from the as-described structures.

(Office Action dated February 2, 2004, hereinafter "OA"; page 31)

It is first noted that the standard is not whether the prior art "would be incapable of obtaining the[] properties", and the standard for rejecting a case based upon inherency is not for the Examiner to note a few structural features and then require the inventors to perform experiments.

> In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.

Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)

Inherency only happens if the elements (1) are necessarily present and (2) one of ordinary skill in the art recognize or appreciate the inherent element. See, e.g., *Galaxo Inc. v. Novopharm Ltd.*, 52 F.3d 1043, 1046 (Fed. Cir. 1995). Moreover, inherency may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient. *Continental Can Co. v. Monsanto*, 948 F.2d 1264, 1269 (Fed. Cir. 1991). The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) Furthermore,

> in relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990).

MPEP 2112 (emphasis added) However, in attempts to advance prosecution, explain the novelty and non-obviousness of the present application, explain that the claimed elements are not cause/result effective variables and are not attained with routine experimentation or mere optimization, to show that the properties do not necessarily flow, and to meet the Examiner's request for proof, Appellants submitted declarations in related divisionals. However, the Examiner did not find the declarations persuasive. The Examiner stated:

> Dr. Feist... argues that, regarding the Chang reference "it is not obvious or even logical to think that a floppy disk has an edge lift of less than 8μ, a surface roughness of less than about 10 Å, and an axial displacement peak of less than about 500 μ under shock or vibration excitation"... The Examiner does not find the declaration convincing since the properties such as "edge lift height" and surface roughness are simply a matter of insuring uniform polishing and deposition and are deemed to easily be attainable if not necessarily present...
>
> While the Examiner acknowledges the language "floppy" implies certain characteristics of the disc formed, the Examiner again notes that the properties that applicants' are claiming may or may not be necessarily present in the substrate formed according to the Chang reference... applicants have provided no measurements of the Chang example to illustrate that it either does or does not necessarily possess the claimed properties, is incapable of obtaining the claimed properties, or both.

(Final Rejection dated November 19, 2003, U.S. Patent Serial No. 09/845,743, page 32)

It is noted that the lack of persuasiveness may be the application of an incorrect standard ("'deemed' to easily be attainable" if not necessarily present). The Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. Considering the references as a whole and their teachings of using different designs, materials, and methods to attain different properties, and since these references have, in the Examiner's words, a

substantially identical in structure (i.e., they discuss elements such as substrates, data layers, reflective layers, dielectric layers, and/or protective layers), the references themselves provide evidence that properties do not necessarily flow due to structures with these elements.

In a further attempt to advance prosecution and show that the variables were not necessarily present, and the at the elements are not cause/result effective variables, Appellants supplied Kang et al. that clearly and objectively sets forth that merely because a media comprises a various layers, the various media are not "substantially identical", have different properties. Kang et al. clearly show that edge-lift height does not necessarily flow because media are "substantially identical".

Elements claimed by Appellants have been pointed to in various references by the Examiner to show that these types of elements exist, but there is not teaching, evidence, support, or reason to believe that the claimed elements are mere optimizations; to believe that they are cause/result effective variables. Even the knowledge that low surface roughness, for example, is desired for near-field high density recording media does not render surface roughness a cause/result effective variable or the obtaining of "low" surface roughness "mere routine experimentation". Merely listing all elements that are not found in a reference and finding other references that mention those elements does not then render the elements "cause effective variables" or support a position that the element values are attainable via routine experimentation. The fact that these elements are not attainable by routine experimentation is not only supported by Kang et al., but is also supported by these references.

These references address issues such as warp and roughness in various fashions to attempt to produce novel disks. They in no way teach or suggest that any of these variables are cause/result effective or are merely optimizable. To the contrary, they discuss several problems in the prior art and attempt various ways of addressing the problems. Sandstrom discusses flatness but fails to teach or suggest edge-lift height or axial displacement, and teaches a thick disk (i.e., thickness ≥1.5 mm) in order to attain the desired properties; Zou et al. address deflection and warp in disk substrates with thinner and thinner dimensions by particular material choice (Col. 1, lines 29 – 50); Czubarow et al. disclose a disk with a cermet layer on a porcelain

substrate having multiple crystalline phases (Abstract); Stanish et al. disclose particular ceramic-metal matrix compositions for magnetic disk substrates (Abstract); Hirata et al. disclose a cavity surface for injection molding information recording disks (Abstract); Annacone et al. disclose a substrate with a core and a smoothing layer (Col. 4, lines 24 - 26); Yamaguchi discloses a glass-ceramic substrate having a particular composition can be used for magnetic disk (Abstract); Hartog et al. disclose a substrate super polishing process where a disk is machined to a predetermined surface roughness; Tenhover et al., who address warpage of aluminum-based disks, disclose ceramic disks with a silicon carbide smoothing layer (Col. 1, line 65 – Col. 2, lines 10; Col. 3, lines 44 – 50); Bonnebat et al. address buckling in injection-molded disk members. As is evident from all of these references, numerous factors affect substrate quality and use for different applications (optical, near-field, etc.).

Although new media are constantly being developed, and various attempts at improving the properties have been made, the improvements are not simple, obvious, or mere "cause effective variables". Several factors can affect properties such as edge-lift, axial displacement, and others. A mere statement that "flatness" is desired is neither enabling, a teaching that flatness can be attained through "mere optimization", or even what is meant by flatness. "Flatness" is a relative term. In the context of the reference, the article may be considered "flat", but in no way attain a "flatness" disclosed and taught in another reference. A media can look flat yet, microscopic fluctuations therein can affect the media's usefulness. Appellants have taught and claimed a specific method and a specific combination of elements for storage media that are neither taught nor suggested by the references, are not cause effective variables, and are not mere optimizations. A *prima facie* case of obviousness has not been established by listing numerous references to show that various properties had been recognized by the art.

B. SUMMARY OF THE ART

As can be noted from the "Issues" section hereof, many of the references are employed in various combinations and/or in view of "evidence" allegedly provided by other references to

allegedly render the present application unpatentable. In order to simplify the rejections, clarify the teachings of the references, and to clearly and concisely respond to the rejections, descriptions of all of the references are set for below.

Landin et al. are directed to a method for internally damping a rotatable storage article, which is subject to resonant vibration. (Abstract) Landin et al. at least fail to teach a storage media having a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation. They also fail to teach resonance frequencies, first modal frequencies, areal densities, and other elements of the present claims.

Wu et al. teach a high density magnetic recording medium with high HR and low MRT by employing particular layers with particular parameters. Wu et al. do not address tilt or solve the deficiencies of the other references of record. Wu et al. at least fail to teach a storage media having a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation.

Chang is directed to a method of making a high density recording medium having a non-magnetic metallic layer on a flexible substrate, wherein the high density recording medium can be used as floppy disk with greater data storage capacity (Abstract). Chang fails to teach at least fail to teach a storage media having a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation.

Otada et al. disclose that to improve surface smoothness so that the deformation is prevented at the time of forming an underlying and magnetic layer and to permit reduction in weight and improvement in productivity by coating the surface of a ceramic substrate with a heat resistant plastic layer (Abstract). Otada et al. at least fail to teach a storage media having a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation.

Sandstrom, Quantgey, Zou et al., Czubarow et al., and Stanish et al., are all relied upon as alleged evidence support the Examiner's contention that

> it would have been obvious to one having ordinary skill in the art to have minimized the results effective variables such as the "edge lift height" and "axial

> displacement peak" to values meeting applicants' claimed limitations through routine experimentation, especially given the knowledge in the art that low values of edge lift and axial displacement peak are desired for increased areal recording density...

(OA, pages 3 – 4, 13, and 22)

Hirata et al., Annacone et al., Yamaguchi, Hartog et al., Tenhover et al., and Bonnebat et al., are all relied upon as alleged evidence that

> it would have been obvious to one having ordinary skill in the art to have minimized the results effective variable "surface roughness" to values meeting applicants' claimed limitations through routine experimentation, especially given the knowledge that extremely low (i.e., < 10 Å) surface roughness values are required for near-field high density recording media...

(OA, pages 4, 13, and 22)

Hirata et al., Yamaguchi, Hartog et al., Tenhover et al., Bonnebat et al., and/or Annacone et al. are relied upon to as alleged evidence that

> areal recording density is a function of the track width, track density, type of magnetic layer, properties of the magnetic layer and the spatial location of the head relative to the medium, and is hence not a property solely of the media, per se.

(OA, pages 5, 13, and 23)

With respect to allegedly teaching that moment of inertia, flexural modulus, moisture content variability, specific gravity, modal frequencies less than an operating frequency, mechanical damping coefficient, resonant frequency, and first modal frequency, are cause effective variables, Bonnebat et al. and Quantgey; Annecone et al., Bonnebat et al., Czubarow et al., and Kuromiya et al.; Czubarow et al., Bonnebat et al., and Quantegy; Mori et al., Stanish et al., and Bonnebat et al.; Miyake et al., Kuromiya et al., and Oniki et al.; Landin et al. and Mori et al.; Miyake et al., Kuromiya et al., and Oniki et al.; Miyake et al., Kuromiya et al., and Oniki et al.; respectively, are relied upon. (OA, pages 6 – 7, 15, and 24) These are considered result or cause effective variables:

> since one of ordinary skill in the art at the time of applicants' invention would recognize that controlling all of these properties to within applicants' claimed limitations are necessary, and desirable, in order to achieve a dimensionally stable, high start-stop time recording media for high areal recording density applications.

(OA, pages 7, 15 – 16, and 24 – 25)

Kikuchi, Oishi, Zager et al., Fujii et al., and Vedamuttu, although listed in the rejection of Claims 1, 5 - 7, 11-30, 32, 33, and 37-59, as evidence, their relevance to the rejection remains unclear since they are not otherwise discussed.

C. REMARKS

1. CLAIMS 11 – 13 AND 18 COMPLY WITH THE WRITTEN DESCRIPTION REQUIREMENT.

Claims 11 – 13 and 18 had been amended to more clearly claim the present invention. The amendment had specified that the plastic resin portion have a particular edge lift. In the specification, edge-lift is discussed as causing damage to read/write devices if too large. Paragraph [0115] discusses that, in some embodiments, the storage media has an edge-lift of less than about 8 μ. Clearly for the storage media to have such an edge-lift, the plastic resin portion must also have such an edge-lift. Hence, the ranges provided in paragraph [0034] regarding the substrate clearly also apply to the plastic resin portion as would be readily understood to one of ordinary skill in the art and by the teachings of the present application. Therefore, Claims 11 – 13 and 18 comply with the written description requirement.

2. Analysis of the Art With Respect to the Present Invention

a. CLAIMS 1, 5 – 7, AND 11 – 59 ARE NON-OBVIOUS IN VIEW OF LANDIN ET AL.; CLAIMS 1, 4 - 7, 11-31, 33-36, 39, 42, 45, 46, 48, 51-53, AND 56-59 ARE NON-OBVIOUS OVER CHANG; CLAIMS 1, 5 - 7, 11-30, 32, 33 AND 37-59 ARE NON-OBVIOUS OVER OTADA ET AL. IN VIEW OF LANDIN ET AL.; AND CLAIMS 32, 37, 38, 40, 41, 43, 44, 47, 49, 50, 54, AND 55 ARE NON-OBVIOUS OVER CHANG IN VIEW OF LANDIN ET AL.

As stated above, Landin et al. are directed to a method for internally damping a rotatable storage article, which is subject to resonant vibration. Landin et al. introduce a viscoelastic material as an inner layer(s) of a rotatable storage article. (Abstract) Landin et al. at least fail to teach a storage media comprising a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation. Furthermore, the OA states that:

> Landin et al. disclose...at least one plastic resin portion (*Figure 3, element 12a*) disposed between at least one data layer (*element 16a*) and a substrate (*element 14 and col. 9, lines 46 – 55*)

(OA, page 3; *emphasis* in original) However, it is first noted that, dampening material 12*a* is not disposed between the data layer 16*a* and the substrate 14; it is disposed within the substrate 14.

With respect to the elements of surface roughness and axial displacement, the OA contends that:

> it would have been obvious to one having ordinary skill in the art to have minimized the results effective variables "edge lift height" and "axial displacement" to values meeting applicants' claimed limitations through routine experimentation, especially given the knowledge in the art that low values of edge lift and axial displacement peak are desired... <u>as evidenced by Sandstrom, Quantegy, Zou et al., Czubarow et al., and Stanish et al</u>....

(OA, page 4; <u>emphasis</u> in original) It is first noted that Claim 1 is not limited to a particular edge-lift height. This section appears to be cut and pasted from a final rejection in a related

divisional application and is not appropriate here. With respect to the axial displacement and surface roughness, as well as to all of the other variables that are labeled as "cause effective variables" or "result effective variables" as discussed above in Section VIII.A, merely mentioning a variable and/or suggesting that an improvement in that variable would be desirable does not render that variable cause/result effective. These variables are not inherent, cause effective, or taught or suggested by Landin et al. Additionally, there is no basis in fact and/or technical reasoning provided to reasonably support the Examiner's position. A *prima facie* case of obviousness has not been established.

Chang is directed to a floppy disk; i.e., floppy – "tending to flop". Clearly, such a media has an axial displacement of greater than 500μ and would not even be considered for any application where low axial displacement is discussed; it is floppy. Additionally, this is not analogous art and an artisan would not consider combining teachings of a floppy disk in work with hard disks. The requirements, properties, etc., of the various media are different. As an artisan would not refer to technology regarding reel film for teachings about hard disks, an artisan would not refer to teachings about floppy disks. At minimum, there would be no expectation of success. Chang at least fails to teach a storage media comprising a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation.

Regarding Chang, the OA states:

> Regarding the limitations of "edge-lift height" and "an axial displacement peak", it would have been obvious to one having ordinary skill in the art to have minimized the results effective variables such as "edge-lift height" and "axial displacement"...

(OA, page 13) It is noted that Claim 1 is not limited to "edge-lift height". With respect to these variables being cause/result effective, Appellants respectfully disagree as is set forth above in Section VIII.A; no basis in fact and/or technical reasoning has been provided.

Otada et al. disclose a magnetic disk substrate and teach that

> to improve surface smoothness so that the deformation is prevented at the time of forming an underlying and magnetic layer and to permit reduction in weight and improvement in productivity by coating the surface of a ceramic substrate with a heat resistant plastic layer.

(Abstract) As with Landin et al. and Chang, Otada et al. at least fail to teach a storage media comprising a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation.

Landin et al., Chang, and Otada et al. also fail to teach or suggest many of the claimed element of dependent claims, such as the claimed: modal frequency, moment of inertia, edge-lift height, areal density, damping coefficient, etc. Considering that all of these references at least fail to teach or suggest a storage media comprising a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation, as is claimed in the present application, even the combination of these references fails to render the present claims obvious.

Regarding Claims 5 – 7 , the Examiner claims that

> areal density is a function of track width, track density, and spatial location of the head relative to the medium, and is not a property solely of the media, per se ...

(OA, pages 4 – 5) Head – media separation is not part of the *definition* of *areal density*. "*Areal density*, also sometimes called *bit density*, refers to the amount of data that can be stored in a given amount of hard disk platter "real estate". Since disk platter surfaces are, of course, two-dimensional, areal density is a measure of the number of bits that can be stored in a unit of area (e.g., track per inch times bits per inch). As is taught throughout the present application, obtaining the desired areal density is a function of various properties and combinations of those properties; i.e., there is a ***structural difference*** that enables a greater areal density. For example, that is why a much greater storage density is obtained on a compact disk than a floppy disk. The properties are different thereby enabling a different density. Appellants contend that the storage densities do add patentable subject matter.

Appellants do not disagree that, in order to read a disk having a particular areal density, one must have a device capable of reading such density. However, Appellants are not claiming the read/write device, Appellants are claiming a media that is capable of supporting a certain amount of data; i.e., having a particular areal density. For example, if you look at a floppy disk, it will have, printed on the encasing, "1.44 MB"; i.e., an areal density of 1.44 megabytes. The areal density refers to what the *media is capable of supporting*. Appellants have clearly and specifically claimed areal density and request that these claims be given proper consideration.

With respect to Claim 57, it is alleged that

> since no numerical values for the modulus or specific gravity are claimed in claim 57, if the first modal frequency is outside the operating frequency range then clearly whatever the value of the modulus and specific gravity, these values clearly are adequate to "place the first modal frequency outside of *an* operating frequency range."

(OA, page 7) It is noted that Claim 57 depends from Claim 1 and therefore, by definition, includes all of the elements of Claim 1, and is non-obvious for at least that reason. Additionally, as is explained in the specification, a combination of factors can be use to obtain a desired first modal frequency. Appellants have required the first modal frequency of the media to be outside of its operating frequency, as is discussed in the specification. None of the references of record teach or suggest such a media.

With respect to Claims 35 and 36, as discussed above, the damping material disclosed in Landin et al., is not a plastic resin portion disposed between a substrate and a data storage layer.

Regarding Claims 40, 41, 43, and 44, the Examiner refers to Figure 4b to illustrate a core having a varied thickness "(*Figure 4b, where the core varies from zero to non-zero across the width of the medium – elements 52 – 54*)". (OA, page 8, *emphasis* in original) Appellants respectfully disagree. In Figure 4b, Landin et al., show a core having a constant thickness and having hollow areas and areas comprising damping material. However, contrary to the

Examiner's contention, they fail to illustrate or mention a core having a varied thickness. If the Examiner is contending that the design of the core is a cause effective variable, Appellants disagree as is explained above in Section VIII.A.

b. CLAIMS 2, 8 – 10, AND 60 ARE NON-OBVIOUS OVER LANDIN ET AL. OR CHANG IN VIEW OF HIRATA ET AL. AND NON-OBVIOUS OVER OTADA ET AL. IN VIEW OF LANDIN ET AL. AND FURTHER IN VIEW OF HIRATA ET AL.

Claims 2, 8 – 10, and 60 are allowable for at least the reasons that Claim 1 is allowable over these references. Landin et al., Otada et al, and Chang, as discussed above, alone and in combination, at least fail to teach or suggest a storage media having a surface roughness of less than about 10Å and an axial displacement peak of less than about 500μ under shock or vibration excitation.

Hirata et al. do not cure the deficiencies of Landin et al. or Chang, or even the improper combination of Landin et al. with Chang. Yet, even combined, these references continue to at least fail to teach a storage media having a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation, as is taught and claimed in the present application. A *prima facie* case of obviousness has not been established.

It is noted that all the references of record teach specific designs and methods to attain certain results. Merely picking and choosing from the teachings of these references to reconstruct the present claims fails to establish a *prima facie* case of obviousness. The references must provide a motivation to combine as well as an expectation of success. Additionally, the fashion in which each media functions and the results desired by the inventors thereof must also be taken into consideration. For example, there is no teaching, suggestion, or motivation provided for inserting a reflective layer from Hirata et al. into the media of Landin et al. or of Chang, or any expectation of success. Additionally, even combined as suggested, the

combination does not render the present claims obvious. A *prima facie* case of obviousness has not been established.

c. CLAIM 3 IS NON-OBVIOUS OVER LANDIN ET AL. OR CHANG IN VIEW OF YAMASHITA ET AL. AND NON-OBVIOUS OVER OTADA ET AL. IN VIEW OF LANDIN ET AL. AND FURTHER IN VIEW OF YAMASHITA ET AL.

Claim 3 is allowable for at least the reasons that Claim 1 is allowable over Landin et al., Chang, and Otada et al., alone and in combination. Yamashita et al., as with Landin et al., Otada et al, and Chang, fail to teach or suggest a storage media has a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation.

Yamashita et al. are relied upon in the OA to show rotation at a variable speed. However, no motivation to combine or expectation of success is provided. There is no motivation or expectation of success to combine these references. For example, there is no motivation or expectation of success provided that rotating the media of Landin et al. at a variable speed will be successful. Merely picking and choosing teachings from various references using the present claims as a template does not render the present claims obvious. Additionally, even combining the references as suggested fails to attain the claimed invention. Finally, merely labeling missing claim elements as "cause effective variables" fails to meet the burden of establishing a *prima facie* case of obviousness. A *prima facie* case of obviousness has not been established.

d. CLAIM 4 IS NON-OBVIOUS OVER LANDIN ET AL. IN VIEW OF WU ET AL. AND NON-OBVIOUS OVER OTADA ET AL. IN VIEW OF LANDIN ET AL. AND FURTHER IN VIEW OF WU ET AL.

Claim 4 is allowable for at least the reasons that Claim 1 is allowable over Landin et al., and Otada et al., alone and in combination with Wu et al. As set forth above, all of these references at least fail to teach or suggest a storage media has a surface roughness of less than

about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation. Claim 4 is directed to coercivity of the data layer; Wu et al. are relied upon to teach "that for high areal density, the 'linear recording density can be increased by increasing the coercivity of the magnetic recording medium'…". Wu et al., however, fail to remedy the deficiencies of Otada et al. and Landin et al.. Hence, even the combination of these references fails to establish a *prima facie* case of obviousness.

IX. CONCLUSION:

In summary, a *prima facie* case of obviousness has not been established for any of the claims of the present application. The claimed elements that have not been found in the prior art are neither "necessarily present" nor cause/result effective variables, as is at least supported by the Kang et al. article as well as by the cited references. The art of record itself provides evidence: (i) that there is a continued need in the art to improve storage media, and (ii) that the properties are not inherent (e.g., media having similar layers (e.g., substrate and layers)) can have very different properties due to how the media was formed, processed, its composition, etc. The rejections based upon inherency (e.g., that the property is "necessarily present") are improper (fail to provide a basis in technical reasoning or logic) and incorrect since the media described by the cited references can be produced without the allegedly inherent property as is supported by Kang et al. Inherency may not be established by probabilities or possibilities.

All of the claims of the present application are non-obvious in view of the art of record, alone or in combination, and in view of the "evidence" provided by the Examiner. Additionally, all of the claims are supported by the specification. Considering that the claimed media are non-obvious, and that the properties are not "necessarily present" or "cause effective variables", the Examiner has failed to establish a *prima facie* case of obviousness. In view of the foregoing, it is urged that the rejection of Claims 1 – 60 be overturned and the claims allowed. The rejections are in error and should be reversed.

If there are any additional charges with respect to this Appeal Brief, please charge them to Deposit Account No. 07-0862.

Respectfully submitted,

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Date: June 7, 2004

APPENDIX A

CLAIMS

1. (Previously Presented) A method for retrieving data, comprising:

rotating a storage media comprising at least one plastic resin portion disposed between at least one data layer and a substrate, wherein said storage media has a surface roughness of less than about 10Å and an axial displacement peak of less than about 500 μ under shock or vibration excitation;

directing an energy field at said storage media such that said energy field is incident upon the data layer before it can be incident upon the substrate; and

retrieving information from the data layer via said energy field.

2. (Original) The method for retrieving data as in Claim 1, further comprising passing at least a portion of said energy field through the data layer, and reflecting said portion of said energy field back through the data layer.

3. (Original) The method for retrieving data as in Claim 1, further comprising rotating said storage media at a variable speed.

4. (Original) The method for retrieving data as in Claim 1, wherein said data layer has a coercivity of greater than about 1,500 oersted.

5. (Previously Presented) The method for retrieving data as in Claim 1, wherein said storage media has an areal density capability of greater than about 6 $Gbits/in^2$.

6. (Previously Presented) The method for retrieving data as in Claim 5, wherein said areal density capability is greater than about 10 $Gbits/in^2$.

7. (Previously Presented) The method for retrieving data as in Claim 6, wherein said areal density capability is greater than about 25 $Gbits/in^2$.

8. (Proposed Amendment) The method for retrieving data as in Claim 1, wherein said plastic resin portion further comprising surface features disposed.

9. (Original) The method for retrieving data as in Claim 8, wherein said surface features are selected from the group consisting of pits, grooves, edge features, asperities, and a combination comprising at least one of the foregoing surface features.

10. (Original) The method for retrieving data as in Claim 8, wherein said surface features have a replication of greater than about 90% replication of an original master.

11. (Previously Presented) The method for retrieving data as in Claim 1, wherein said plastic resin portion has an edge-lift height of less than about 8 μ.

12. (Previously Presented) The method for retrieving data as in Claim 11, wherein said edge-lift height is less than about 5 μ.

13. (Previously Presented) The method for retrieving data as in Claim 12, wherein said edge-lift height is less than about 3 μ.

14. (Original) The method for retrieving data as in Claim 11, wherein said substrate has a mechanical damping coefficient of greater than about 0.04 at a temperature of 24°C.

15. (Original) The method for retrieving data as in Claim 14, wherein said substrate has a mechanical damping coefficient of greater than about 0.06 at a temperature of 24°C.

16. (Original) The method for retrieving data as in Claim 1, wherein said axial displacement is less than about 150 μ.

17. (Original) The method for retrieving data as in Claim 16, wherein said axial displacement is less than about 125 μ.

18. (Previously Presented) The method for retrieving data as in Claim 17, wherein said plastic resin portion has an edge-lift height of less than about 8 μ.

19. (Original) The method for retrieving data as in Claim 16, wherein said substrate has a mechanical damping coefficient of greater than about 0.04 at a temperature of 24°C.

20. (Original) The method for retrieving data as in Claim 19, wherein said substrate has a mechanical damping coefficient of greater than about 0.06 at a temperature of 24°C.

21. (Previously Presented) The method for retrieving data as in Claim 1, wherein said storage media has a moment of inertia of less than about 5.5 x 10^{-3} slug-in^2.

22. (Original) The method for retrieving data as in Claim 21, wherein said moment of inertia is less than about 4.5 x 10^{-3} slug-in^2.

23. (Original) The method for retrieving data as in Claim 22, wherein said moment of inertia is less than about 4.0 x 10^{-3} slug-in^2.

24. (Original) The method for retrieving data as in Claim 1, wherein said roughness is less than about 5 Å.

25. (Original) The method for retrieving data as in Claim 1, wherein said substrate has a

mechanical damping coefficient of greater than about 0.04 at a temperature of 24°C.

26. (Original) The method for retrieving data as in Claim 25, wherein said mechanical damping coefficient is greater than about 0.06 at a temperature of 24°C.

27. (Original) The method for retrieving data as in Claim 1, wherein a moisture content of said substrate varies less than about 0.5% at equilibrium under test conditions of 80°C at 85% relative humidity after 4 weeks.

28. (Original) The method for retrieving data as in Claim 1, wherein said substrate has a resonant frequency of greater than about 250 Hz.

29. (Original) The method for retrieving data as in Claim 1, wherein said substrate has a specific gravity of less than about 1.5.

30. (Original) The method for retrieving data as in Claim 1, wherein said substrate comprises a material selected from the group consisting of an amorphous, crystalline, semi-crystalline material, and blends, copolymers, mixtures, reaction products, and composites comprising at least one of the foregoing materials.

31. (Original) The method for retrieving data as in Claim 30, wherein said substrate further comprises metal.

32. (Original) The method for retrieving data as in Claim 30, wherein said substrate comprises a resin selected from the group consisting of partially hydrogenated polystyrene, a poly(cyclohexyl ethylene), poly(styrene-co-acrylonitrile), poly(styrene-co-maleic anhydride), and blends, copolymers, mixtures, reaction products, and composites comprising at least one of the foregoing resins.

33. (Original) The method for retrieving data as in Claim 1, wherein said plastic resin portion comprises a resin selected from the group consisting of polyvinyl chloride, polyolefins, polyesters, polyimide, polyamides, polysulfones, polyether imides, polyether sulfones, polyphenylene sulfides, polyether ketones, polyether ether ketones, ABS resins, polystyrenes, polybutadiene, polyacrylates, polyacrylonitrile, polyacetals, polycarbonates, polyphenylene ethers, ethylene-vinyl acetate copolymers, polyvinyl acetate, liquid crystal polymers, ethylene-tetrafluoroethylene copolymer, aromatic polyesters, polyvinyl fluoride, polyvinylidene fluoride, polyvinylidene chloride, tetrafluoroethylene fluorocarbon polymer, and blends, copolymers, mixtures, reaction products, and composites comprising at least one of the foregoing resins.

34. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises metal.

35. (Original) The method for retrieving data as in Claim 34, wherein said plastic resin portion is a film having a thickness of less than about 50μ.

36. (Original) The method for retrieving data as in Claim 35, wherein said thickness is less than about 20μ.

37. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises reinforcement selected from the group consisting of fibers, whiskers, fibrils, nanotubes, particulate, and combinations comprising at least one of the foregoing reinforcements.

38. (Original) The method for retrieving data as in Claim 37, wherein said substrate further comprising reinforcement selected from the group consisting of metal, plastic, mineral, ceramic, glass, and combinations comprising at least one of the foregoing reinforcements.

39. (Original) The method for retrieving data as in Claim 1, wherein said substrate has a substantially constant thickness.

40. (Original) The method for retrieving data as in Claim 1, wherein said substrate has a varied thickness.

41. (Original) The method for retrieving data as in Claim 1, wherein said substrate has a cross-sectional geometry selected from the group consisting of concave, convex, tapered, and combinations comprising at least one of the foregoing thickness geometries.

42. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a core having a substantially constant thickness.

43. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a core having a varied thickness.

44. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a core having a cross-selected geometry selected from the group consisting of concave, convex, tapered, and combinations comprising at least one of the foregoing core geometries.

45. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a core having a core outer diameter substantially equal to a substrate outer diameter.

46. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a core having a geometry selected from the group consisting of at least one radial arm, at least one ring, star-like, and combinations comprising at least one of the foregoing geometries.

47. (Original) The method for retrieving data as in Claim 1, wherein said substrate further

comprises a core having at least one hollow cavity.

48. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a core having at least one filled cavity.

49. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a core having multiple portions.

50. (Original) The method for retrieving data as in Claim 49, wherein said multiple portions comprise different materials.

51. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a preformed core.

52. (Original) The method for retrieving data as in Claim 1, wherein said substrate further comprises a core formed in situ with said substrate.

53. (Original) The method for retrieving data as in Claim 1, further comprising at least one insert attached to said substrate.

54. (Original) The method for retrieving data as in Claim 53, wherein said insert comprises a plurality of portions attached to said substrate on a surface of said substrate opposite said data layer.

55. (Original) The method for retrieving data as in Claim 53, wherein said insert comprises a single member having a substantially uniform thickness, said insert attached to said substrate on a surface of said substrate opposite said data layer.

56. (Previously Presented) The method for retrieving data as in Claim 1, wherein said storage media has a first modal frequency greater than an operating frequency.

57. (Previously Presented) The method for retrieving data as in Claim 1, wherein the storage media possesses a flexural modulus and specific gravity that places the first modal frequency outside of an operating frequency range.

58. (Previously Presented) The method for retrieving data as in Claim 1, wherein said storage media has only one modal frequency less than an operating frequency.

59. (Original) The method for retrieving data as in Claim 1, wherein the substrate possesses a flexural modulus of greater than about 250 kpsi.

60. (Previously Presented) The method for retrieving data as in Claim 1, wherein said plastic portion comprises pits and grooves.

APPENDIX B

KANG ET AL. ARTICLE

Presented at "International Symposium on Optical Media" 2003

We-PP-04

A Study on Spin Coating Method for Cover Layer of Blu-ray Disc

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Abstract

Spin coating method for cover layer of Blu-ray Disc (BD) has been studied. The effects of resin viscosity, spinning speed, spinning time, and variables on ski-jump of cover layer were investigated. A vacuum chuck was newly designed to minimize the ski-jump effect.

Optical storage media, including CD (compact disc) and DVD (digital versatile disc) have been developed rapidly last three decades. Recently, in order to meet the demand for increasing optical disc capacity to serve high-definition quality of picture and sound, Blu-ray Disc (BD) having capacity over 23 GB is being developed. BD requires a transparent cover layer of 100 μm on the top of recording layer.[1] Decre and Vromans presented two possible approach for the cover layer; spin coating and bonding of a polycarbonate (PC) sheet.[2] Among these technologies, spin coating is a good method due to some advantages including small residual focusing error and low processing cost. However, a major problem of spin coating is the ski-jump, which is made at the rim area of disc because of viscoelastic nature of polymer. Chang *et al.* have investigated a spin coating technique for making 100 μm thick cover layer,[3] but the ski-jump problem still remains unsolved.

In this study, we investigated the effects of resin viscosity, spinning speed, spinning time, and variables on the uniformity, thickness, ski-jump, and ski-jump width of cover layer. And we newly designed a vacuum chuck in order to decrease ski-jump and ski-jump width of cover layer.

A 1.1 mm thick polycarbonate (PC) disc deposited with multi-layered film including recording layer was used as a substrate. UV-curable resins with various viscosities (3500, 5900, 10600, and 15000 cP at 25 °C) for spin coating on PC substrates were prepared. Their shrinkage on UV-curing showed 5.0 ± 0.2 %, and the transmittance at 405 nm for 100 μm thickness was 92 %. The resin was dispensed on the center position of a PC substrate. A vacuum chuck was newly designed to minimize a ski-jump during spin coating.

Fig. 1 shows changes in the thickness of the cover layer versus spinning time with different viscosity. The data presented in Fig. 1 are the average of 32 points on the coated disk except ski-jump area. As the resin viscosity increases, higher spinning speed is required for 100 μm thick cover layer with 30 sec spinning time. It has been found that uniform 100 μm thick cover layer can be obtained independent of a resin viscosity. The overall thickness of cover layer was 100 ± 2 μm as shown in Fig. 2. We investigated the changes in ski-jump and ski-jump width with the increasing resin viscosity and spinning speed at which we obtained 100 μm thick cover layer. Additionally, we newly designed a vacuum chuck and compared the effect of vacuum chuck on ski-jump

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and ski-jump width. The results are shown in Table 1. When a conventional vacuum chuck was used, the ski jumps of cover layer were more than 50 μm regardless of a viscosity. Using newly designed vacuum chuck, ski-jump and ski-jump width decreased remarkably. Especially, at the viscosity of 15000 cP and at the spinning speed of 1700 rpm the ski-jump and the ski-jump width were 6.2 μm and 0.6 mm, respectively. We also investigated the effect of minor parameters such as dosing amount, spinning speed for dosing, and spin acceleration rate on the uniformity, thickness, ski-jump, and ski-jump width of cover layer. These minor parameters have little effect on the above characteristics of the cover layer.

In conclusion, the resin viscosity does not effect the uniformity of cover layer. However, the higher the resin viscosity and spinning speed, the smaller the ski-jump and ski-jump with of cover layer. Newly designed vacuum chuck works very well to reduce the ski-jump o f a cover layer.

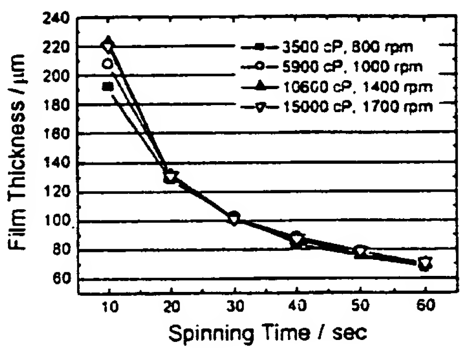

Figure 1. The film thickness variations as a function of spinning time.

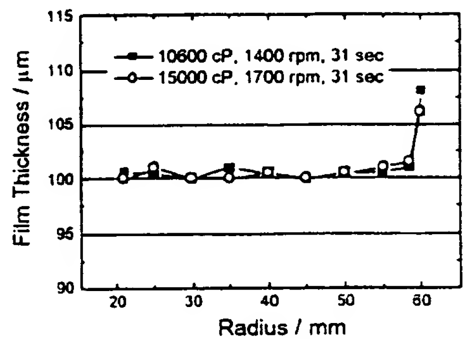

Figure 2. Radial distribution of cover layer thickness.

Table 1. The effects of a conventional vacuum chuck and a newly designed vacuum chuck on ski-jump and ski-jump width.

Condition for 100 μm thick cover layer		3500 cP /800 rpm /33 sec	5900 cP /1000 rpm /32sec	10600 cP /1400 rpm /31 sec	15000 cP /1700 rpm /31 sec
Conventional vacuum chuck	Ski-jump (μm)	54.3	58.5	55.8	56.1
	Sik-jump width (mm)	2.7	2.3	1.7	1.2
Newly designed vacuum chuck	Ski-jump (μm)	16.2	10.1	8.5	6.2
	Sik-jump width (mm)	2.0	1.3	0.8	0.6

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